Smart Tape For Structural Health Monitoring of Rocket Engines, Phase I

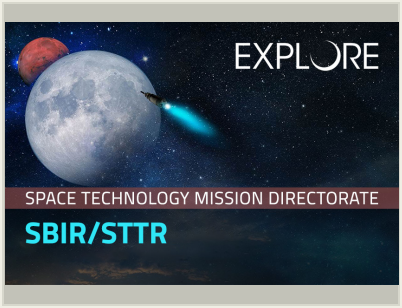
Completed Technology Project (2005 - 2005)

Project Introduction

Acellent Technologies, Inc. proposes to develop a SMART TAPE system that can be used to perform rapid non-destructive evaluation in real time and provide long-term monitoring of pressure vessels in liquid rocket engines. Based on Acellent's existing SMART Layer technology, this innovative system combines a sensor network, dedicated signal processing and data analysis software to allow for real-time in-situ monitoring and long term tracking of structural integrity of pressure vessels (such as ducts, manifolds and combustion chambers) in rocket engines. Specifically, the proposed structural health monitoring system will have the following unique features: ? Ability to detect cracks and corrosion ? Prevent imminent and catastrophic failures in rocket engines ? Survive harsh environments and missions ? Inspect inaccessible areas without disassembly The proposed innovation is important since it will address the need for safe as well as reliable advanced space exploration vehicle/propulsion systems as part of the human and robotic technology (HR&T) objectives of NASA's Space Exploration Initiative. As part of the latter objective, approaches to verify and validate the proposed structural health monitoring system with an integrated propulsion and vehicle real-time health management system simulator will be defined and evaluated.

Anticipated Benefits

Other potential users of the proposed technology include a wide range of industries such as: ? Chemical piping ? Pressured vessels and pipes ? Oil drilling platforms and drill risers ? Nuclear power plant containment vessels ? Post-tensioned concrete structures ? Composite wraps for bridge reinforcement The key to achieving a wide range of applications is the development as discussed above. Once developed, the system will be available in a complete package including the SMART TAPE, the portable diagnostic unit, and diagnostic software. The turnkey feature of the system will make it easy and ready to apply for any end-user. This technology can be applied to numerous NASA applications such as rapid in-situ inspection of Earth-to-Orbit LH2/LOX and LOX/Hydrocarbon engines. This is important in meeting the needs of the human and robotic technology (HR&T) objectives of NASA's Space Exploration Initiative. The Structural Health Monitoring System for rocket engines can interface and integrate with an integrated propulsion and vehicle health management system. This technology addresses is the need for an easy rapid inspection tool for engines used in space vehicles that has the advantage of being completely integrated with the structure monitoring it from cradle to grave.



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Marshall Space Flight Center (MSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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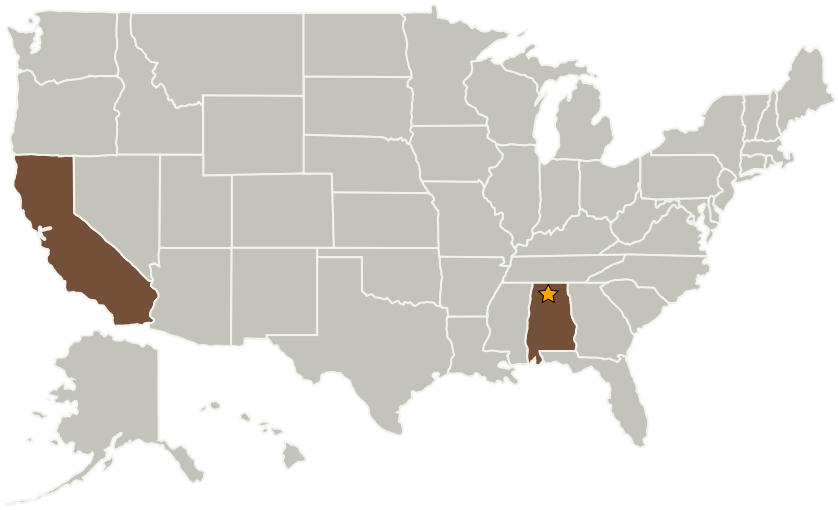
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Marshall Space Flight Center(MSFC)	Lead Organization	NASA Center	Huntsville, Alabama
Acellent Technologies, Inc.	Supporting Organization	Industry Small Disadvantaged Business (SDB), Women-Owned Small Business (WOSB)	Sunnyvale, California

Primary U.S. Work Locations	
Alabama	California

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Project Manager:
Katherine K Mims

Principal Investigator:
Peter X Qing

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.2 Structures
    - TX12.2.3 Reliability and Sustainment